CTN Test Report

CALS TEST NETWORK 90-045

AFTB-ID-90-013

Technical Publication Transfer Test Using GTE Government Systems Provided Data: MIL-M-28001 (SGML) and MIL-R-28003 (CGM)

Quick Short Test Report

October 25, 1990

REVISED

Prepared for
Air Force Logistics Command
Air Force CALS Test Bed (LMSC/SBC)
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Technical Publication Transfer

Using GTE Government Systems

Provided Data:

MIL-M-28001 (SGML)

MIL-R-28003 (CGM)

Quick Short Test Report

25 October 1990

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1.   Introduction

1.1   Background

The DOD Computer-aided Acquisition and Logistic Support (CALS)
Test Network (CTN) is conducting tests of the military standard
for the Automated Interchange of Technical Information, MIL-STD-
1840A, and its companion suite of military specifications. The
CTN is a DOD-sponsored confederation of voluntary participants
from industry and government managed by the Air Force Logistics
Command.

The primary objective of the CTN is to evaluate the effectiveness
of the CALS standards (Standards) for technical data interchange
and to demonstrate the technical capabilities and operational
suitability of those Standards. Two general categories of tests
are performed to evaluate the Standards, formal and informal.
Formal tests are large, comprehensive tests that follow a written
test plan, require specific authorization from DOD, and may take
months to prepare, execute, and report.

Informal tests are quick and short, taking only a few hours to
set up and execute. They are used by the CTN technical staff to
broaden the testing base by including representative samples of
the many systems and applications used by CTN participants. They
also allow the CTN staff to gain feedback from many industry and
government interpretations of the Standards, to increase the base
of participation in the CALS initiative, and to respond, in a
timely manner, to the many requests for help that come from
participants. Participants take part voluntarily and are bene-
fited by receiving an evaluation of their latest implementation
(interpretation) of the Standards, interacting with the CTN
technical staff, gaining experience in use of the Standards, and
developing increased confidence in them. The results of informal
tests are reported in Quick Short Test Reports (QSTRs) that
briefly summarize the standard(s) tested, the hardware and soft-
ware used, the nature of the test, and the results.

1.2   Purpose

The purpose of the informal test reported in this QSTR was to
analyze GTE Government Systems' interpretation and use of the
CALS standards in transferring technical publications data in-
cluding CGM files. GTE used its CALS Technical Data Interchange
System to produce data in accordance with the Standards and
delivered it to the CTN technical staff on a 9-track magnetic
tape.

2.   Test Parameters

Test Plan: AFTB 90-13

**Date of
Evaluation:**   October 25, 1990

Evaluators: Air Force CALS Test Bed
                             HQ AFLC LMSC/SNX
                             Wright-Patterson AFB, OH 45433-5000

**Data
Originator:**   GTE Government Systems Corporation
                             80 "A" Street
                             Needham, MA 02194

**Data
Description:**   Operation and Technical Manual
                             Red Telephone Switching Subsystem
                                     1 text file
                                     91 CGM files

**Data
Source System:**

                    Text/SGML
                             DEC MicroVAX II system
                                     Author Editor
                             IBM PC
                                     FastTag

                    CGM
                             Macintosh II
                                     Claris MacDraw II
                                     GSC Associates GraphPorter

**Evaluation
Tools Used:**

                    1840A   SUN 3/280
                                     CTN TAPETOOL (v1.0)   UNIX
                             SUN 3/60
                                     Agfa Compugraphics CALS

SGML   Cheetah Gold 486
                Exoterica XGML
        SUN 3/60
                Agfa Compugraphics CALS

CGM

                Metacals

**Standards
Tested:**   MIL-STD-1840A Notice 1
                MIL-M-28001
                MIL-D-28003

3.   1840A Analysis

3.1   External Packaging

The tape arrived at the Air Force Test Bed enclosed in a box IAW ASTM D 3951. The exterior of the box was marked with the required magnetic tape warning label, MIL-STD-1840A, para. 5.3.1.3.

The tape was not enclosed in a barrier bag or barrier sheet material as required by MIL-STD-1840A, para. 5.3.1.2. Enclosed in the box was a packing list showing all files that were recorded on the tape.

3.2   Transmission Envelope

The nine-track tape received by the Air Force Test Bed contained MIL-STD-1840A files. The files were named per the standard conventions.

3.2.1   Tape Formats

The 1840A Tape was run through the AFTB TAPETOOL utility version 1.1. No errors were encountered while evaluating the contents of the tape labels.

The tape was also run into the AFTB system using Agfa Compugraphics read1840A utility. No errors were noted.

3.2.2   Declaration and Header Fields

No errors were reported with these files.

4.   SGML Analysis

The GTE Government systems text submission consisted of 165 pages of tagged text with seven tagged tables. GTE provided a listing of the type tag and number of occurrances in the document. This list is in included in Appendix E.

The text file from this document was tested using the Software
Exoterica XGML parser. With the text file parsed using the
38794B DTD, over 500 errors were reported. Many of these errors
relate to the external entity references made at the start of the
document.

Parsing the file without the 38784B DTD, over 300 errors were
reported. The majority of these errors relate to incorrect ROW
references in tables. A shortened part of the error log is shown
in Appendix B.

The file was also parsed using the SOBEMAP product in Agfa Com-
pugraphics CAPS/CALS. The initial parsing attempt was
not successful. The problem was in the added information on the
DOCTYPE line of the SGML document. Once this information was
removed the document parsed with errors. They relate to TABLE
callouts and were the same errors as reported by XGML.

The document was then made into an Agfa CAPS document and dis-
played on the screen. Currently, the Agfa product does not sup-
port CGM files so these were not inserted into the screen dis-
play.

5. **CGM Analysis**

This tape contained 91 CGM files. Agfa Compugraphics has just
announced a CGM addition to their CALS software. This should be
available in the near future in the AFTB for CGM analysis.

These files were checked by Bruce Garner of CTNO Technical Opera-
tions Lab ,LLNL. Appendix D is the results of the this analysis.

6.   **Conclusions and Recommendations**

In summary, the MIL-STD-1840A tape from GTE Government Systems
was correct. The tape could be read properly using the CTN TAPE-
TOOL Software without errors

The SGML file was read correctly and processed using the Agfa
CALS/CAPS software. Many errors resulted during the parsing
operation which could be traced to TABLE calls in the document
when using both the SOBEMAP and XGML parser.

For conclusions and recommendation of CGM files see Appendix D of
this report.

7.   **Appendix A - Tape Tool Report Logs**

7.1   **Tape Catalog**

CALS Test Network Tape Evaluation - Version 1.1

MIL-STD-1840A Tape Evaluation Catalog

Mon Oct 22 17:01:19 1990   Document File Set Directory:
/cals/tapetool2/Set018

Page: 1

File Name	File Type	Record Type	Record Length
d001	Document Declaration	D	00260
d001t001	Text	D	00260
d001c001	CGM	F	00080
d001c002	CGM	F	00080
d001c003	CGM	F	00080

<<<<<<<<< Remainder of file deleted >>>>>>>>>

7.2   **Tape Import Log**

CALS Test Network Document File Set Validation - Version 1.1

MIL-STD-1840A Imported Document File Set Validation Log

Found file: d001
Renaming Document Declaration file: d001
Extracting 1840A Document Declaration header records...
Validating Document Declaration header records...

srcsys: GTE_GOVERNMENT_SYSTEMS_CALS_VAX_B
srcdocid: RTSS_OPER_AND_MAINTENANCE_MANUAL_VOL1
srcrelid: NONE
chglvl: ORIGINAL
dteisu: 19900919
dstsys: CALS_TEST_NETWORK_HQ_AFLC_LMSC/SJT_WRIGHT-PATTERSON AFB
dstdocid: RTSS_OPER_AND_MAINTENANCE_MANUAL_VOL1
dstrelid: NONE
dtetrn: 19900918
dlvacc: NONE
filcnt: T1,C91
ttlcls: UNCLASSIFIED
doccls: UNCLASSIFIED
doctyp: Technical Publication
docttl: NONE

Saving Document Declaration header file: d001_hdr

Found file: d001t001
Renaming Text file: d001t001
Extracting 1840A Text header records...
Validating Text header records...

srcdocid: RTSS_OPER_AND_MAINTENANCE_MANUAL_VOL1
dstdocid: RTSS_OPER_AND_MAINTENANCE_MANUAL_VOL1
txtfilid: W
doccls: UNCLASSIFIED
notes: NONE

Saving Text header file: d001t001_hdr
Saving Text data file: d001t001_txt

Found file: d001c001
Renaming CGM file: d001c001
Extracting 1840A CGM header records...
Validating CGM header records...

srcdocid: RTSS_OPER_AND_MAINTENANCE_MANUAL_VOL1
dstdocid: RTSS_OPER_AND_MAINTENANCE_MANUAL_VOL1
txtfilid: W
figid: F1
srcgph: C1
doccls: UNCLASSIFIED
notes: NONE

Saving CGM header file: d001c001_hdr
Saving CGM data file: d001c001_cgm

<<<<< PART OF LOG REMOVED HERE >>>>>>>

Checking file count...
No errors were found.
File Count verification complete.

No errors were encountered in document d001.

No errors were encountered during validation.

MIL-STD-1840A File Set Validation Complete.

7.3   **Tape Error Log**

No errors reported.

8.   **Appendix B - Parser Logs**

8.1   **Exoterica Parser Error Log**

```
C:\XGML\XGMLNORM.EXE --
Error on line 549 in file \9013\d001t001:
Undeclared attribute specification.
For start tag 'TABLE': Unknown attribute is 'SCILEVEL'.
Allowed attributes for the element 'TABLE' are: 'ID', 'INSCHLVL',
'DELCHLVL', 'LABEL', 'TEXTTYPE', 'ITEMID', 'CONFIG', 'SKILLTRK', 'HCP'
and 'XREF'.

C:\XGML\XGMLNORM.EXE --
Error on line 560 in file \9013\d001t001:
Attribute does not have a current value.
For start tag 'ENTRY': For CURRENT NMTOKEN attribute 'ROW'..

C:\XGML\XGMLNORM.EXE --
Error on line 562 in file \9013\d001t001:
Attribute does not have a current value.
For start tag 'ENTRY': For CURRENT NMTOKEN attribute 'ROW'..

C:\XGML\XGMLNORM.EXE --
Error on line 569 in file \9013\d001t001:
Attribute does not have a current value.
For start tag 'ENTRY': For CURRENT NMTOKEN attribute 'ROW'..

C:\XGML\XGMLNORM.EXE --
Error on line 571 in file \9013\d001t001:
Attribute does not have a current value.
For start tag 'ENTRY': For CURRENT NMTOKEN attribute 'ROW'..
```

<<<<<<<<<< **Remainder OF LOG REMOVED HERE** >>>>>>>>>>
<<<<<<<<<< **MORE ROW ERRORS** >>>>>>>>>>

8.2   **Agfa Compugraphics Parser Log**

```
<!--*** file:nold.T.sgm line:560 pos:23292
Missing first specification of a CURRENT default value type attribute
(ROW)-->

<!--*** file:nold.T.sgm line:562 pos:23332
Missing first specification of a CURRENT default value type attribute
(ROW)-->
```

```
<!--*** file:nold.T.sgm line:569 pos:23400
Missing first specification of a CURRENT default value type attribute
(ROW)-->

<!--*** file:nold.T.sgm line:571 pos:23435
Missing first specification of a CURRENT default value type attribute
(ROW)-->
```

```
559        <THEAD>
560        <ROW>
561        <ENTRY COL="1">MAJOR COMPONENT
562        </ENTRY>
563        <ENTRY COL="2">DESCRIPTION
564        </ENTRY>
565        </ROW>
566        </THEAD>
567
568        <TBODY>
569        <ROW>
570        <ENTRY COL="1">RED Switch
571        </ENTRY>
572        <ENTRY COL="2">
573        </ENTRY>
574        </ROW>
```

                <<<<<<<<< PART OF LOG REMOVED HERE >>>>>>>>>
                   <<<<<< MORE TABLE-ROW ERRORS >>>>>>>>>>

9. Appendix C - SGML Tags Used

NAME	COUNT	DESCRIPTION
BODY	1	Body Matter
CHAPTER	1	Chapter
COLBDDEF	7	Column Body Definition
COLHDDEF	19	Column Heading Definition
CONTENTS	1	Generated Table of Contents
CONTRNO	1	Contract Number
DEF	161	Definition
DEFLIST	19	Definition List
DOC	1	Document Level Element
DOCNO	1	Document Number
DOCTYPE	1	Document Type
ENDEMPH	258	End Emphasis
ENTRY	382	Table Entry
FIGURE	91	Figure
FRONT	1	Front Matter
GLOSSARY	1	Glossary
GLOSSHD	19	Glossary Head
GRAPHIC	91	Graphic
IDINFO	1	Title Page
ILUSLIST	1	Generated Illustration List
LEP	1	Gen. List of Effective Pages
MFR	1	Manufacturer
MODELNO	1	Equipment Model Number
NOMEN	1	Equipment Nomenclature
NOTICE	2	Notice
PARA	11	Paragraph
PARA0	22	Primary Paragraph
PARATEXT	720	Paragraph Text
PRECAUT	5	Precaution
PRTITLE	1	Prime Title
PUBDATE	1	Publication Date
PUBNO	1	Publication Number
REAR	1	Rear Matter
ROW	131	Table Row
SAFESUM	1	Safety Summary
SECTION	3	Section
STEMPH	258	Start Emphasis
STEP1	262	Procedural Step, First Level
STEP2	19	Procedural Step. Second Level
SUBPARA1	79	Subordinate Paragraph, 1
SUBPARA2	78	Subordinate Paragraph, 2
SUBPARA3	67	Subordinate PAragraph, 3
TABDEF	9	Table Definition
TABLE	9	Table

TABLIST	1	Generated List of Tables
TBODY	9	Table Body
TERM	161	Symbol
THEAD	8	Table Head
TITLE	350	Title
TITLEBLK	1	Title Block Matter
USER	1	User Service
WARNING	6	Warning
WARNSUM	1	Warning Summary
XREF	138	Cross Reference

10. **Appendix D - CGM Analysis**

The 91 metafiles were stripped of their MIL-STD-1840A headers at
AFTB. They were provided to CTNO Technical Operations Lab on DOS
floppy disk.

Each of the 91 GTE metafiles was analyzed with two beta version
programs for analysis of CGMs. These CGM analysis programs,
ValidCGM and MetaCALS, check CGMs for agreement with the re-
quirements of MIL-D-28003 and, in the case of MetaCALS, with the
requirements of ANSI/ISO 8632 also. The errors reported are
discussed in this report.

All of the metafiles were interpreted and plotted with MetaView
on an IBM compatible (DOS) personal computer. In addition, some
of the files also were plotted with CGMView and/or GPLOT on a
SUN/3 computer running under the UNIX operating system.

This is a revised report. The initial report generated consid-
erable discussion of our interpretation of the reported testing.
This lead to a better understanding of the requirements of the
ANSI/ISO standard for CGM, for the CALS application profile for
CGM, and lead to refined and improved operational procedures for
interchange tests such as this one. The revised report is a
result of this improved understanding.

10.1 **Analysis**
10.1.1 **File Size**

The GTE CGMs, stripped of their 1840A headers, ranged from 960
bytes to 146,880 bytes. File sizes are listed in Table 2.

10.1.2 **Elements used in GTE CGMs**

The general nature of the GTE illustrations, nearly all of which
are schematic diagrams of communications systems, leads to a
general similarity in the metafiles and to a relative simplicity
in their make-up of CGM elements. All of the files use the same
set of Delimiter, Metafile Descriptor, Picture Descriptor, At-
tribute, Escape and External Elements. The detailed values of
the parameters for each were not examined. Only one file,
d004.cgm, invokes a Control Element. Only three to six types of
Graphical Primitive Elements are used in any one metafile. To
the extent examined, the POLYLINE element is used only for
two-point lines. This differs from previously examined metafiles
in which large numbers of POLYLINEs with hundreds of points are

the primary tool for construction of complex images. The con-
struction of the GTE files is a relatively efficient construc-
tion.

The number of different elements used and the number of occur-
rences of each are summarized in Table 1.

10.1.3 Summary of Graphical Primitive Elements used in GTE CGMs

The GTE CGMs use from 27 to 677 Graphical Primitive Elements per
file. This relatively small element count is a result of the
type of image represented, generally schematic diagrams made up
of regular closed shapes with connecting lines and arrows and
with labels.

Eight Graphical Primitive Elements are used. They are POLYLINE,
RESTRICTED TEXT, POLYGON, CELL ARRAY, RECTANGLE, ELLIPSE, ELLIP-
TICAL ARC, and ELLIPTICAL ARC CLOSE. The use of CELL ARRAY
materially increased the size of the files in which it was used.

The number of occurrences of each Graphical Primitive Element in
each GTE metafile is given in Table 2.

10.1.4 Discrepancies in CGM files

Each of the 91 GTE metafiles was analyzed with a pre-release
version of MetaCALS and with the "beta" version of ValidCGM.
Compliance with MIL-D-28003 requires compliance with the base
standard, ANSI/ISO 8632, and with the additional specifications
and restrictions of MIL-D-28003. The MetaCALS analysis software
checks CGMs for agreement with the requirements of either
ANSI/ISO 8632 alone or with those of MIL-D-28003 additionally.
ValidCGM looks primarily at agreement with the requirements of
MIL-D-28003.

END METAFILE Element Missing (ISO 8632/ANSI X3.122 error)

This usage is not allowed by either ISO 8632 and MIL-D-28003.

The END METAFILE element is missing in seven metafiles, d016,
d029, d056, d058, d068, d077 and d089. It must be presumed that
this error would not occur in a production transfer, in which
both sending and receiving systems have been well tested. In the
present instance it is not known where the END METAFILE element
was lost. However, as the END PICTURE element is present, it is
unlikely that other data was trimmed away. Within the CTN

project, this error occurred in non-routine procedures which
added MIL-STD-1840A headers to the CGMs.

This error had no observable effect on image transfer. Compari-
son with the original files would be necessary to determine
whether or not any data was lost, but data loss is considered
unlikely.

This problem seems to be a result of either the preparation or
the reading of the MIL-STD 1840A tape under "laboratory" condi-
tions.

        CHARACTER SET LIST Element

Two sets of files were tested for CHARACTER SET LIST contents.
Following a violation report from MetaCALS on the first set and
some dispute among the interested parties over interpretation of
the MIL-D-28003 specifications, adjustments were made to the CGM
generating software and a new set of files was submitted and
tested. The new files are completely correct in the contents of
the CHARACTER SET LIST.

The violation report from MetaCALS, on the original set of files,
was the only MIL-D-28003 related message in the original testing
(it occurred in each file). The author of the generating soft-
ware interpreted the specification as requiring the 3-character
strings "4/2" and "4/1" for the designation tail sequences,
whereas it is now agreed that the CGM standard and MIL-D-28003
actually require the single characters in positions 4/2 and 4/1
of the code table to be used (which are respectively "B" and "A"
in the ASCII character set).

The disagreement over interpretation arose due to the complex and
confusing nature of this particular specification in MIL-D-28003
-- it requires careful reference to the CGM standard itself, and
to an altogether different ISO standard as well (ISO 2022) in
order to accurately define the notation. Research subsequent to
the initial testing has indicated that this misinterpretation is
frequent. In discussions among the concerned parties it was
agreed that the text of MIL-D-28003 should be clarified to help
prevent this misinterpretation. This recommendation will be made
during the current review of Revision A of MIL-D-28003.

Regardless of the dispute over the validity of the original
violation report from MetaCALS, the "violation" in the original
set of files had no practical effect, i.e., it had no effect on
the graphical image which would be displayed by any correct
interpreter, no effect on the usability of the files in inter-

change, and would not have been valid cause for rejection of the
files as deliverables.

The CGM generating software has been modified subsequent to the
first test and ensuing discussion. The CHARACTER SET LIST ele-
ments generated by this CGM generator are now error free and are
completely in agreement with the agreed interpretation of the
MIL-D-28003 specification.

10.2   Comments on plots of GTE metafiles

Comparison of plots of the received metafiles with plots produced
by the originating system showed several visual discrepancies, as
follows:

    Shift to the left of text strings unless interpreter option
    selected. "Blocking" of some parts of image represented by
    CELL ARRAY.

The "blocking" is sufficiently serious that pictures would re-
quire minor editing of the received images prior to publication.

10.2.1   Shift to left of RESTRICTED TEXT strings

It is well known in the graphics standards community that place-
ment of a text string within the bounding rectangle of the RE-
STRICTED TEXT element is not well defined. This uncertainty
affects both the CGM generator and the CGM interpreter. There is
uncertainty both in the creation of the bounding rectangle by the
generator and in the placement of text in the bounding rectangle
by the interpreter. In this instance the generating software,
GraphPorter, is known to define a "box" that just fits the dis-
played text. However, the current version of the CGM standard
does not require a matching fit of the text string into the
defined "box". This "fuzzyness" in the standard is not a problem
when the interpreter is written to conform to common practice.
One interpreter used in this study, MetaView, permits operator
selection of either of two modes of placement of text in the
bounding rectangle of the RESTRICTED TEXT element. One of these
modes gives a satisfactory interpretation of the text strings as
intended by the originating system.

All text in the GTE metafiles is represented by the RESTRICTED
TEXT element. Figure 1 shows the originating system's plot of
the image of file, d004.cgm, and Figures 2 and 3 show the
MetaView plots with the two available modes for RESTRICTED TEXT.

Amendment 3 to ISO 8632 (CGM) provides means for exactly defining the placement of text within the bounding rectangle of the RE-STRICTED TEXT element. A draft of MIL-D-28003A, currently being reviewed by CALS, also will incorporate this more exact definition.

10.2.2 "Blocking" of image by CELL ARRAY

There are several instances in interpreting the 91 metafiles from GTE where portions of the image which appear in the original plots do not appear in the plots obtained from the receiving CGM interpreters. This occurs several times in the previously referenced file, d004.cgm, as shown in Figure 3. Again, the clear text conversion of the files permits not only examination of the files for reasons for this behavior, but also modification of the files to illustrate the problem.

In each case the files include the CELL ARRAY element, used generally to insert a small "picture" into the otherwise schematic image. In the originating system, the black on white "pictures" are transparent in the white regions, so that the CELL ARRAYs may be overlapped without blocking the previously plotted image. The CGM standard includes a TRANSPARENCY element that applies to several graphical primitive elements, but does not apply to the CELL ARRAY element. Consequently the CGM standard requires that a CELL ARRAY element block the previously laid down image.

Figure 4 illustrates the blocking of the previously laid down image by subsequently plotted CELL ARRAYs.

A recommendation for application of transparency to CELL ARRAY background color has been prepared. This change would apply both to the ANSI/ISO standard and to MIL-D-28003A. In the meantime, members of the ISO committee responsible for CGM have been asked to consider a "fix" to this problem and an appropriate change to the standard already is under consideration.

For the present, the user of graphics programs which permit CELL ARRAYs with transparent background should keep in mind that appearance may differ when the image file is translated to CGM.

10.3 Conclusions and recommendations

The transfer of GTE illustrations in the form of Computer Graphics Metafiles was generally successful with the interpreters available at the receiving system.

The GTE metafiles made good use of the more complex graphical primitive elements such as rectangle and ellipse. Polylines were used only for simple lines between two points.

Analysis of the CGMs with the MetaCALS and ValidCGM programs for evaluation against the requirements of ISO 8632 and MIL-D-28003 revealed one deviation in a required character string for the CGM element, CHARACTER SET LIST. There is disagreement among CGM "experts" as to the exact requirement of MIL-D-28003 in this matter. Several files were found to be missing the required END METAFILE element. Neither discrepancy prevented correct interpretation of the transferred CGMs.

The use of the RESTRICTED TEXT element for all text provided an example of the problems that may occur due to the present imprecise definition of this CGM element in the ISO standard for Computer Graphics Metafile. At present, it is necessary the determine whether generating and receiving systems provide compatible treatment of the RESTRICTED TEXT element.

Blocking of some parts of several images was caused by the improper use of the CELL ARRAY element. CGM does not permit that background color in a CELL ARRAY be transparent, so that a CELL ARRAY interpreted after other elements may block out the previously laid down image. It is recommended that the CGM standards, ANSI/ISO 8632 and MIL-D-28003, be modified to permit transparency for CELL ARRAYs as practiced in many drawing programs.

Table 1.   Distribution of CGM elements.

The files included the following distribution of elements:

Element Class		Number of different elements	Number of occurrences
Delimiter Elements	(Class 0)	5	5
Metafile Descriptor Elements	(Class 1)	14	14
Picture Descriptor Elements	(Class 2)	7	7
Control Elements	(Class 3)	0-1	0- 15
Graphical Primitive Elements	(Class 4)	3-6	27-677
Attribute Elements	(Class 5)	14	11-406
Escape Elements	(Class 6)	0	0
External Elements	(Class 7)	0	0

Only one file, d004.cgm, had a Control Element. File size, the
distribution of Graphical Primitive Elements and total number of
elements for each file are given in Table 2.

Table 2. Occurrence of Graphical Primitive Elements in GTE CGMs
with File Size and Total Number of Elements

Number of each element for each file

Element ---> POLYLINE (4-1)
& Element   RESTRICTED TEXT (4-5)
Number   POLYGON (4-7)
                             CELL ARRAY (4-9)
                                  RECTANGLE (4-11)
                                       ELLIPSE (4-17)
                                            ELLIPTICAL ARC (4-18)
                                                 ELLIPTICAL ARC CLOSE (4-19)

File Number	File Size, Bytes	POLYLINE (4-1)	RESTRICTED TEXT (4-5)	POLYGON (4-7)	CELL ARRAY (4-9)	RECTANGLE (4-11)	ELLIPSE (4-17)	ELLIPTICAL ARC (4-18)	ELLIPTICAL ARC CLOSE (4-19)	Total Elements in Metafile
d001.cgm	5840	110	43			149	12	12	12	338
d002.cgm	7440	170	46			181	25	12	12	446
d003.cgm	10640	256	84			284	25	12	12	673
d004.cgm	27840	398	110	64	9	84	12			677
d005.cgm	5120	93	45	30		44		24	24	260
d006.cgm	5120	92	45	30		44		24	24	259
d007.cgm	5040	91	45	29		44		24	24	257
d008.cgm	5120	96	45	30		44		24	24	263
d009.cgm	5040	95	46	27		44		24	24	260
d010.cgm	5120	96	45	29		44		24	24	262
d011.cgm	5040	94	45	30		44		24	24	261
d012.cgm	5040	93	45	28		44		24	24	258
d013.cgm	5040	96	45	29		44		24	24	262
d014.cgm	4880	89	45	23		44		24	24	249
d015.cgm	3360	101	59	1		36				197
d016.cgm	3520	76	79	1		34				190
d017.cgm	5840	223	70	37		38				368
d018.cgm	6720	266	74	47		38	2	4		431
d019.cgm	2720	121	24			32				177
d020.cgm	1280	13	15	12		8				48
d021.cgm	3120	42	49	30		18		12		151
d022.cgm	1120	12	13	9		6				40
d023.cgm	1920	93	15	8		3				119
d024.cgm	2000	93	15	8		3				119
d025.cgm	1920	93	15	8		3				119
d026.cgm	2800	29	77	1		35				142
d027.cgm	4720	114	103	12		34	4			267
d028.cgm	1760	30	33	10		9				82
d029.cgm	3520	160	30	22		22				234
d030.cgm	3680	141	54	21		16				232
d031.cgm	3680	141	54	21		16				232
d032.cgm	3680	141	54	21		16				232

File										
d033.cgm	3680	141	54	21		16				232
d034.cgm	3680	141	54	21		16				232
d035.cgm	5360	197	71	29		14		16		327
d036.cgm	4800	216	69	8		22		10		325
d037.cgm	5840	105	118	60		10				293
d038.cgm	1120	17	18	1		6				42
d039.cgm	25625	109	44	17	3	9		6		188
d040.cgm	3520	153	41	20		9		5		228
d041.cgm	1760	60	19	7		6				92
d042.cgm	2480	91	28	14		10				143
d043.cgm	7520	131	120	121		15	6	8		401
d044.cgm	2800	42	39	37		3		8		129
d045.cgm	3200	97	55	20		8		4		184
d046.cgm	3680	106	59	22		10	6	8		211
d047.cgm	4880	79	77	72		17				245
d048.cgm	2000	31	31	23		5				90
d049.cgm	4880	79	77	72		17				245
d050.cgm	2560	27	51	21		7		4		110
d051.cgm	1920	52	25	8		3		8		96
d052.cgm	1760	26	28	10		6		4		74
d053.cgm	1680	28	22	8		6		8		72
d054.cgm	1680	28	23	8		6		8		73
d055.cgm	1760	28	23	10		6		8		75
d056.cgm	2000	80	26	8				4		118
d057.cgm	6080	124	107	44		28		36		339
d058.cgm	5040	148	103	41		10	2			304
d059.cgm	119120	176	89	16	10	35		20		346
d060.cgm	5520	59	119	44		32	14	8		276
d061.cgm	5280	183	84	33		8	2	12		322
d062.cgm	2560	94	25	12		4		12		147
d063.cgm	1520	39	22			16				77
d064.cgm	5360	156	72	31		16		28		303
d065.cgm	2480	86	34	15		8				143
d066.cgm	2160	27	27	18				12	12	96
d067.cgm	3200	69	36	37		18				160
d068.cgm	2000	77	21	7		8				113
d069.cgm	2320	30	30	21		23			4	108
d070.cgm	2400	22	32	21		33				108
d071.cgm	2240	49	28	23		10	2			112
d072.cgm	2320	47	32	27		4				110
d073.cgm	2000	58	41			8		8		115
d074.cgm	2720	44	50	26		17				137
d075.cgm	1920	52	32			20				104
d076.cgm	5120	87	90	45		18		20		260
d077.cgm	6080	112	83	69		34		16		314
d078.cgm	4480	76	78	44		26	12			236
d079.cgm	1440	23	20	14		6				63
d080.cgm	146880	23	50	1	5	41	14			134
d081.cgm	2240	51	25	16		10	6			108

d082.cgm	1760	30	25			12		5	5	77
d083.cgm	1360	18	21			12	4	2		57
d084.cgm	8800	106	41	1	1	28	18	2		197
d085.cgm	1600	12	35			14				61
d086.cgm	2000	35	27	16		6		8		92
d087.cgm	1760	59	17	6		8				90
d088.cgm	1440	33	8	12		10				63
d089.cgm	960	3	10	6		8				27
d090.cgm	4720	127	59	37		45				268
d091.cgm	2480	18	60	17		14				109
Minimum	960	3	8	0	0	0	0	0	0	27
Maximum	146880	398	120	121	10	284	25	36	24	677

MetaCALS (Beta Version 2.0) reported that all files have an error in the required string for CHARACTER SET LIST. This was due to different interpretation of MIL-D-28003 and the CGM standard by the authors of the testing tool and the CGM generating software, and should not be reported as an error. MetaCALS correctly reported that seven files were missing the END METAFILE elements.

Table 3. Reported errors in metafiles

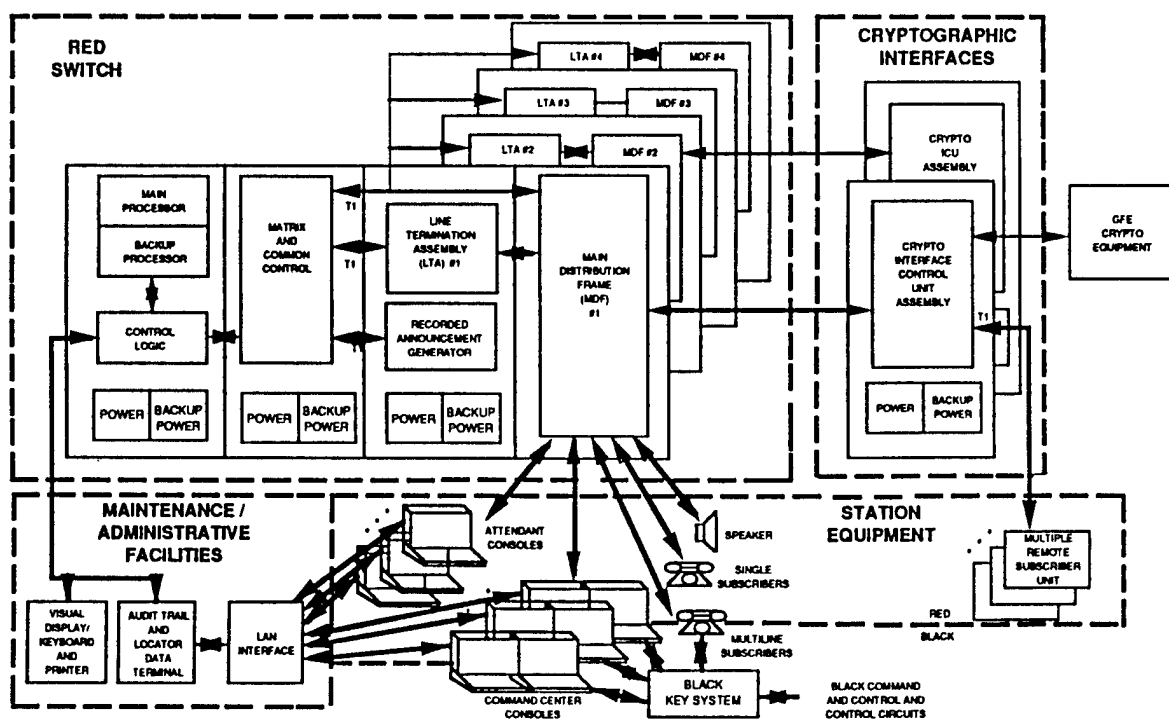| Message	Number of files in which found
CGM errors -	
END METAFILE missing	7
MIL-D-28003 errors -	
CHARACTER SET LIST invalid; must contain exactly the two list entries: (0,"4/2") and (1,"4/1").	91

10.4   List of Figures

Figure 1.   Originating system's plot of metafile, d004.cgm.
This is the reference image for examining the ef-
fects of RESTRICTED TEXT and CELL ARRAY elements.
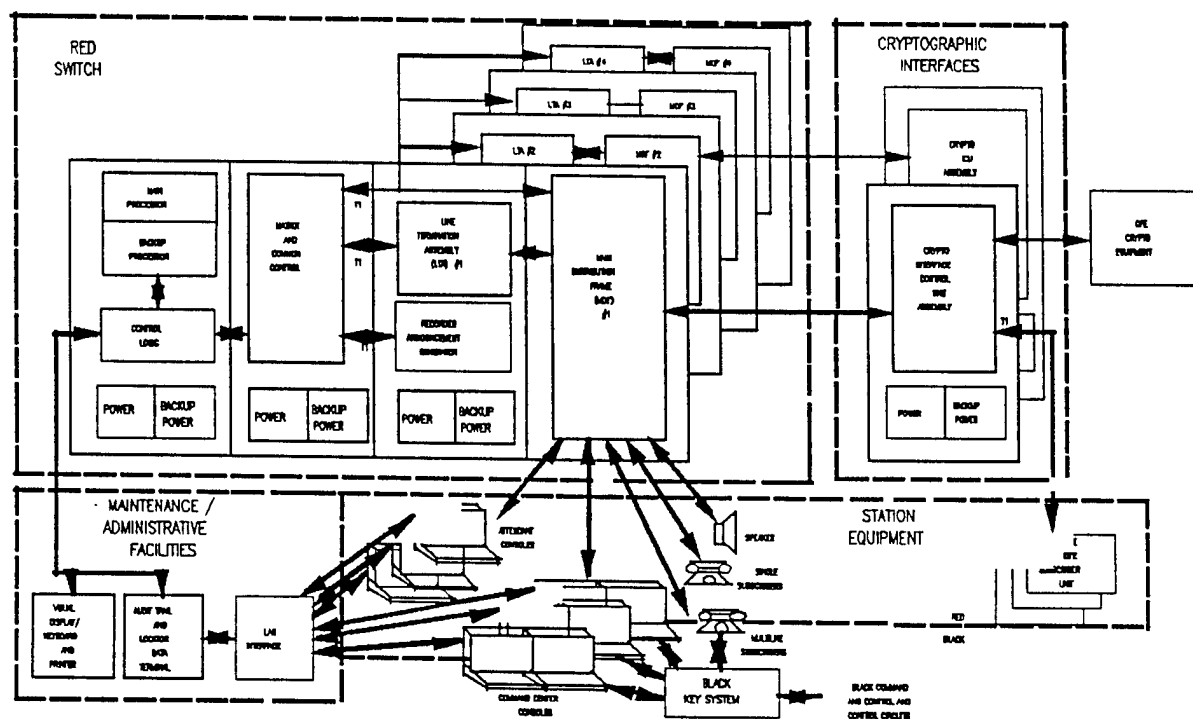
Figure 2.   MetaView plot of metafile, d004.cgm, without "-r"
            option. Text, represented by the RESTRICTED TEXT
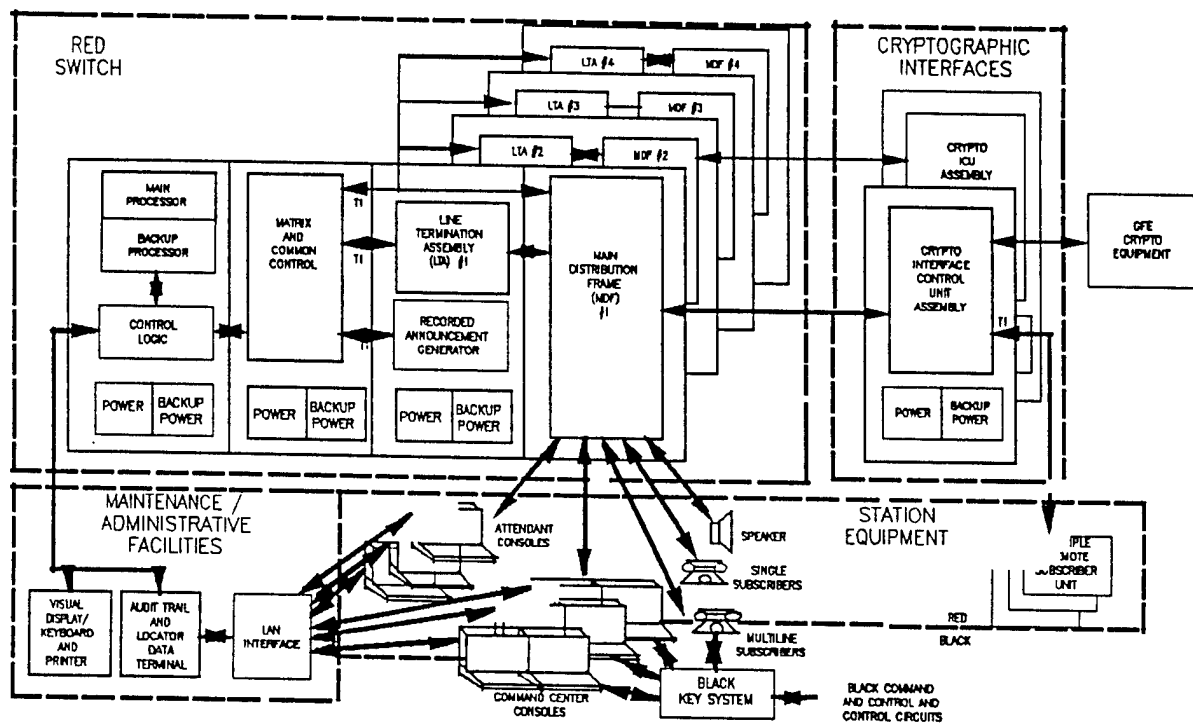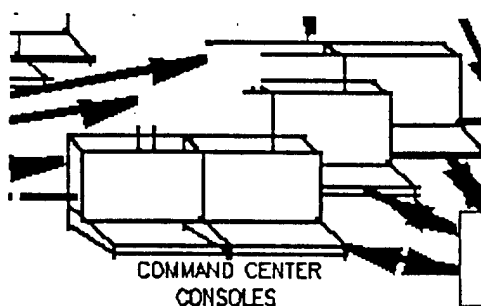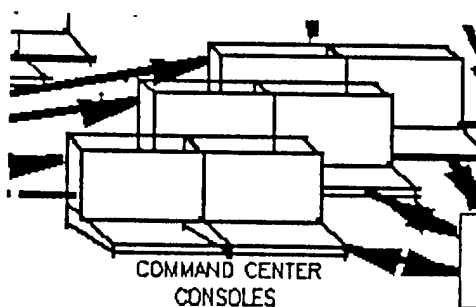   element, is shifted to the left.

Figure 3.   MetaView plot of metafile, d004.cgm, with "-r" op-
             tion. Text, represented by the RESTRICTED TEXT ele-
             ment, is centered and is a satisfactory, though less
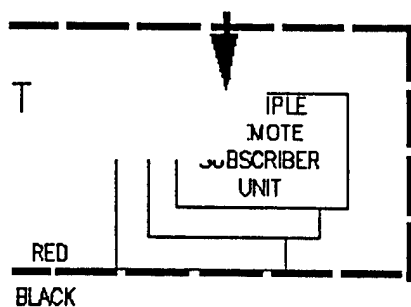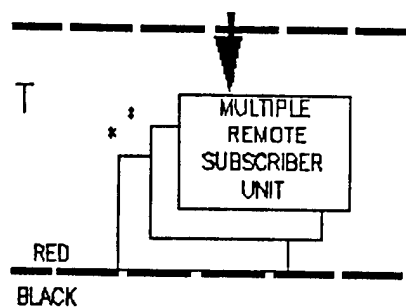   than exact, match to the original text.

With CELL ARRAYs

Without CELL ARRAYS.

```
T                     IPLE
                      .NOTE
                    ᴊᴜBSCRIBER
                      UNIT

RED
BLACK
```

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T              ǂ    MULTIPLE
             *      REMOTE
                    SUBSCRIBER
                      UNIT

RED
BLACK
```

With CELL ARRAYs

Without CELL ARRAYS.

Figure 4.   Demonstration of the image blocking of images by
             CELL ARRAYs. The partial plots on the left, with
             image blocking, are from the CGM with CELL
             ARRAYS; those on the right, without image blocking,
             are from the edited clear text CGM with CELL
             ARRAYs removed.